U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-279 104

Sevier Bridge Reservoir, Juab and Sanpete Counties, Utah

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Nov 77

PB 279 104

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

. 699-440

1a

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. PB279104
4. TITLE AND SUBTITLE Report on Sevier Bridge Reservoir, Juab and Sanpete Counties, Utah		5. REPORT DATE Prepared November 1977 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper # 857
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Eutrophication Survey U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final - 1975 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		48G

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release unlimited		43
	20. SECURITY CLASS *(This page)*	22. PRICE PC A03 / MF A01

EPA Form 2220-1 (9-73)

REPORT
ON
SEVIER BRIDGE RESERVOIR
JUAB AND SANPETE COUNTIES
UTAH

EPA REGION VIII

WORKING PAPER No. 857

WITH THE COOPERATION OF THE

UTAH STATE DIVISION OF HEALTH

AND THE

UTAH NATIONAL GUARD

NOVEMBER, 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Utah Department of Social Services and the Utah Department of Natural Resources for professional involvement, to the Utah National Guard for conducting the tributary sampling phase of the Survey, and to those Utah wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staffs of the Bureau of Water Quality of the Division of Health and the Division of Wildlife Resources provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

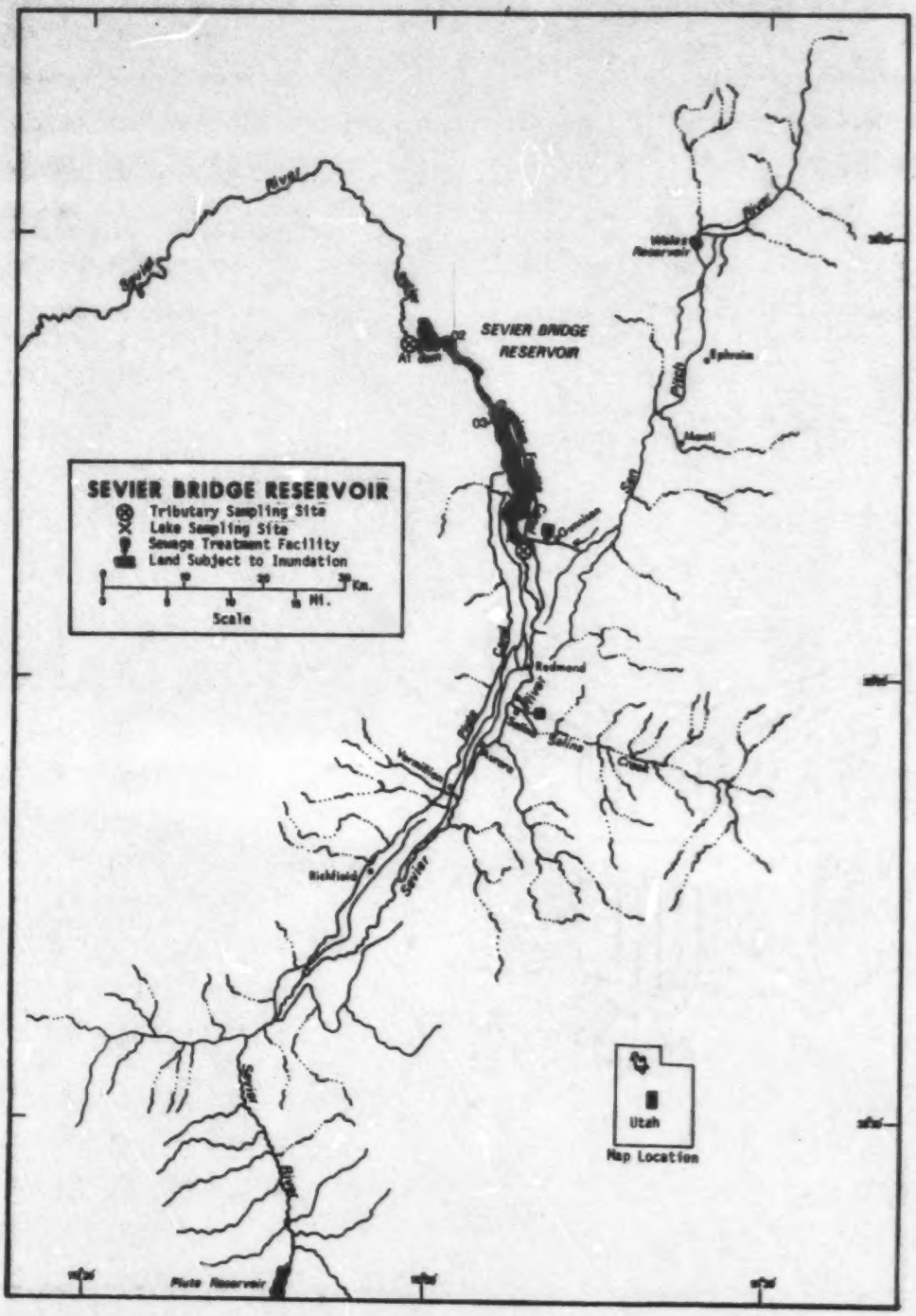
Major General Maurice L. Watts, the Adjutant General of Utah, and Project Officer Lt. Colonel T. Ray Kingston, who directed the volunteer efforts of the Utah National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF UTAH

NAME	COUNTY
Bear	Rich, UT; Bear Lake, ID
Deer Creek	Wasatch
Echo	Summit
Fish	Sevier
Flaming Gorge	Daggett, UT; Sweetwater, WY
Huntington	Emery
Joes Valley	Emery
Lower Bowns	Garfield
Lynn	Box Elder
Minersville	Beaver
Moon	Duchesne
Navajo	Kane
Newcastle	Iron
Otter Creek	Piute
Panguich	Garfield
Pelican	Uintah
Pineview	Weber
Piute	Piute
Porcupine	Cache
Powell	Garfield, Kane, San Juan, UT; Coconino, AZ
Pruess	Millard
Sevier Bridge	Juab, Sanpete
Starvation	Duchesne
Steinaker	Uintah
Tropic	Garfield
Utah	Utah
Willard Bay	Box Elder


SEVIER BRIDGE RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Land Subject to Inundation
Km.
Mi.
Scale
SEVIER BRIDGE RESERVOIR
Redmond
Richfield
Salina
Utah
Map Location
Piute Reservoir

SEVIER BRIDGE RESERVOIR

STORET NO. 4920

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Sevier Bridge Reservoir is eutrophic. It ranked twenty-first in overall trophic quality when the 27 Utah lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Twelve of the water bodies had less median total phosphorus, 16 had less and one had the same median dissolved orthophosphorus, 24 had less median dissolved inorganic nitrogen, 21 had less mean chlorophyll a, and 20 had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at sampling station 1 in August (2.6 mg/l at 15.5 meters).

Survey limnologists noted an algal bloom and submerged macrophytes in the reservoir in May.

B. Rate-Limiting Nutrient:

The algal assay results indicate the reservoir was phosphorus limited in May and September. The reservoir data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--The two known point sources collectively contributed an estimated 8.6% of the total phosphorus load to the reservoir during the sampling year.

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* See Appendix A.

The phosphorus loading of 0.75 g/m^2 measured during the sampling year is nearly twice that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). While even complete removal of phosphorus at the two point sources would still leave a loading of 0.68 g/m^2/yr, the reservoir is phosphorus-limited, and it is likely that a high degree of phosphorus control would result in some improvement in the trophic condition of the reservoir.

2. Non-point sources--Non-point sources, including precipitation contributed a little over 91% of the total phosphorus load during the sampling year. The Sevier River added 86.2%, and the ungaged minor tributaries and immediate drainage contributed an estimated 2.8%.

The phosphorus export rate of the Sevier River was a rather low 2 kg/km^2 during the sampling year (page 10).

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 44.52 kilometers².
2. Mean depth: 6.5 meters.
3. Maximum depth: 22.6 meters.
4. Volume: 291.104 x 10^6 m^3.
5. Mean hydraulic retention time: 1.6 years (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Sevier River	12,742.8	5.720
Minor tributaries & immediate drainage -	473.5	0.203
Totals	13,216.3	5.923

2. Outlet -

Sevier River	13,260.8**	5.610**

C. Precipitation***:

1. Year of sampling: 24.7 centimeters.
2. Mean annual: 26.2 centimeters.

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† Table of metric conversions--Appendix B.
†† Sudweeks, 1975.
* For limits of accuracy, see Working Paper No. 175, "... Survey Methods, 1973-1976".
** Includes area of reservoir; lesser outflow due to evaporation.
*** See Working Paper No. 175.

III. WATER QUALTIY SUMMARY

Sevier Bridge Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at three of the four stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 18.6 meters at station 1, 11.9 meters at station 2, 3.4 meters at station 3, and 2.1 meters at station 4.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR SEVIER BRIDGE RESERVOIR
STORET CODE 4920

PARAMETER	1ST SAMPLING (5/12/75) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (8/12/75) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/24/75) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	7.3 - 12.2	9.9	9.6	15.9 - 19.1	18.5	18.7	16.3 - 19.6	18.4	18.7
DISS OXY (MG/L)	8.6 - 9.8	9.4	9.4	2.6 - 7.0	6.0	6.3	6.2 - 9.6	7.3	7.0
CNDCTVY (MCROMO)	1460. - 2181.	1860.	2134.	2097. - 2730.	2292.	2200.	1809. - 1895.	1861.	1859.
PH (STAND UNITS)	8.4 - 8.7	8.6	8.6	8.1 - 8.5	8.4	8.4	8.3 - 8.6	8.5	8.5
TOT ALK (MG/L)	308. - 405.	348.	352.	334. - 406.	362.	361.	395. - 465.	430.	430.
TOT P (MG/L)	0.019 - 0.065	0.032	0.024	0.022 - 0.129	0.039	0.031	0.022 - 0.090	0.037	0.027
ORTHO P (MG/L)	0.005 - 0.020	0.013	0.015	0.004 - 0.015	0.008	0.006	0.003 - 0.010	0.006	0.005
NO2+NO3 (MG/L)	0.310 - 0.610	0.535	0.600	0.270 - 0.430	0.299	0.285	0.180 - 1.210	0.361	0.209
AMMONIA (MG/L)	0.030 - 0.050	0.036	0.030	0.020 - 0.080	0.056	0.060	0.030 - 0.130	0.089	0.090
KJEL N (MG/L)	0.400 - 0.800	0.623	0.700	0.500 - 1.100	0.680	0.600	0.600 - 1.600	0.891	0.800
INORG N (MG/L)	0.340 - 0.650	0.572	0.640	0.310 - 0.450	0.355	0.350	0.270 - 1.250	0.450	0.300
TOTAL N (MG/L)	1.000 - 1.400	1.158	1.110	0.790 - 1.370	0.979	0.930	0.790 - 2.810	1.252	1.000
CHLRPYL A (UG/L)	2.1 - 17.2	7.5	3.1	2.0 - 54.1	20.5	5.4	3.8 - 71.4	26.7	4.9
SECCHI (METERS)	0.5 - 2.9	1.8	1.9	0.2 - 1.5	1.0	1.2	0.2 - 1.5	1.1	1.5

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/12/75	1. Elakatothrix sp.	1,191
	2. Synedra sp.	496
	3. Chroomonas sp.	347
	4. Cryptomonas sp.	248
	5. Diatoma sp.	149
	Other genera	100
	Total	2,531
08/12/75	1. Crucigenia sp.	2,309
	2. Oocystis sp.	553
	3. Cryptomonas sp.	553
	4. Aphanizomenon sp.	520
	5. Fragilaria sp.	390
	Other genera	1,400
	Total	5,725
09/24/75	1. Cyclotella sp.	937
	2. Nitzschia sp.	386
	3. Tetrastrum sp.	331
	4. Cryptomonas sp.	331
	5. Skeletonema sp.	331
	Other genera	1,268
	Total	3,584

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/12/75	1	3.1
	2	17.2
	3	2.1
	4	-
08/12/75	1	2.0
	2	5.4
	3	54.1
	4	-
09/24/75	1	3.8
	2	4.9
	3	-
	4	71.4

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. May sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.004	0.562	0.4
0.050 P	0.054	0.562	14.3
0.050 P + 1.0 N	0.054	1.562	18.2
1.0 N	0.004	1.562	0.3

b. September sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.010	0.680	0.4
0.050 P	0.060	0.680	11.5
0.050 P + 1.0 N	0.060	1.680	15.2
1.0 N	0.010	1.680	0.4

3. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Sevier Bridge Reservoir was moderate at the times the samples were collected (05/12/75 and 09/24/75). Also, the significant increases in yield with the addition of phosphorus alone in both assays indicates the reservoir was phosphorus limited at those times.

The reservoir data also indicate phosphorus limitation; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 44/1 or greater each sampling time.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Utah National Guard collected monthly near-surface grab samples when possible from each of the tributary sites indicated on the map (page v), except for the high runoff months of May and June when two samples were collected. Sampling was begun in November, 1974, and was completed in October, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Utah District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in kg/km^2/year, at station A-2 and multiplying by the ZZ area in km^2.

The operator of the Gunnison collection system provided only three monthly effluent samples and corresponding flow data; therefore, the nutrient loads in the untreated wastes were estimated at 1.587 kg P and 4.263 kg N/capita/year for the six months of discharge during the sampling year (a non-overflow pond became operational in April, 1975).

The operator of the Salina plant did not participate; nutrient loads from this source were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 m^3/capita/day

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal* -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Gunnison	1,500	none (for six months)	442.8	San Pitch River
Salina**	1,494	tr. filter	565.5	Sevier River

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Sevier River	28,810	86.2
b. Minor tributaries & immediate drainage (non-point load) -	945	2.8
c. Known municipal STP's -		
Gunnison	1,190	3.6
Salina	1,695	5.1
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation*** -	780	2.3
Total	33,420	100.0

2. Outputs -

Reservoir outlet - Sevier River 4,035

3. Net annual P accumulation - 29,385 kg.

* Hinshaw, 1974.
** Anonymous, 1971; population shown is 1970 Census.
*** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Sevier River	661,185	89.1
b. Minor tributaries & immediate drainage (non-point load) -	24,620	3.3
c. Known municipal STP's -		
Gunnison	3,195	0.4
Salina	5,080	0.7
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	48,065	6.5
Total	742,145	100.0

2. Outputs -

Reservoir outlet - Sevier River 258,715

3. Net annual N accumulation - 483,430 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Sevier River	2	52

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.75	0.66	16.7	10.9

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Sevier Bridge Reservoir:

"Dangerous" (eutrophic loading)	0.40
"Permissible" (oligotrophic loading)	0.20

V. LITERATURE REVIEWED

Anonymous, 1971. Inventory of municipal waste facilities. EPA Publ. OWP-1, vol. 8, Wash., DC.

Hinshaw, R., 1974. Treatment plant questionnaire. UT Bur. of Env. Health, Salt Lake City.

Sudweeks, Calvin K., 1975. Personal communication (reservoir morphometry). UT Bur. of Env. Health, Salt Lake City.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	1S-MIN DO	MEDIAN DISS ORTHO P
0408	LAKE POWELL	0.010	0.410	339.830	3.081	13.800	0.007
4901	BEAR LAKE	0.011	0.040	253.167	0.945	9.200	0.003
4902	LOWER BOWN'S RESERVOIR	0.031	0.040	336.000	5.567	9.400	0.006
4903	DEER CREEK RESERVOIR	0.038	0.215	430.333	9.078	14.800	0.006
4904	ECHO RESERVOIR	0.047	0.170	450.333	6.967	14.000	0.012
4905	LYNN RESERVOIR	0.121	0.200	417.667	39.600	10.400	0.052
4906	FISH LAKE	0.023	0.040	152.000	12.483	10.400	0.004
4907	HUNTINGTON NORTH RESERVO	0.013	0.040	392.000	1.900	7.800	0.005
4908	JOE'S VALLEY RESERVOIR	0.012	0.045	400.000	2.483	11.200	0.003
4909	MINERSVILLE RESERVOIR	0.192	0.060	445.000	33.583	8.600	0.107
4910	MOON LAKE	0.008	0.040	381.000	2.700	9.600	0.002
4911	NAVAJO LAKE	0.016	0.040	368.000	2.000	6.000	0.003
4912	NEWCASTLE RESERVOIR	0.051	0.040	428.667	12.467	13.600	0.009
4913	OTTER CREEK RESERVOIR	0.067	0.040	453.667	11.767	10.600	0.033
4914	PANGUITCH LAKE	0.071	0.040	426.500	45.950	14.200	0.010
4915	PELICAN LAKE	0.044	0.080	438.500	6.380	8.400	0.004
4916	PINEVIEW RESERVOIR	0.028	0.300	435.083	9.692	14.600	0.006
4917	PIUTE RESERVOIR	0.047	0.150	482.625	29.329	11.600	0.007
4918	PORCUPINE RESERVOIR	0.025	0.110	440.000	7.860	12.400	0.011
4919	PRUESS RESERVOIR (GARRIS	0.057	0.140	491.000	4.533	8.800	0.008
4920	SEVIER BRIDGE RESERVOIR	0.026	0.355	449.778	18.222	12.400	0.008
4921	STARVATION RESERVOIR	0.016	0.040	394.583	5.675	13.200	0.004
4922	STEINAKER RESERVOIR	0.011	0.040	316.750	1.844	12.600	0.005
4923	TROPIC RESERVOIR	0.021	0.050	425.000	7.200	8.400	0.006
4924	UTAH LAKE	0.132	0.320	496.583	72.812	11.400	0.012
4925	WILLARD BAY RESERVOIR	0.044	0.060	457.182	7.567	11.000	0.009
5605	FLAMING GORGE RESERVOIR	0.011	0.690	285.636	2.500	10.400	0.003

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	SDD-MEAN SEC	MEAN CHLORA	1S-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
0488	LAKE POWELL	96 (25)	4 (1)	81 (21)	73 (19)	15 (4)	42 (11)	311
4901	BEAR LAKE	90 (23)	87 (19)	96 (25)	100 (26)	77 (20)	90 (23)	540
4902	LOWER BOWN'S RESERVOIR	46 (12)	87 (19)	85 (22)	65 (17)	73 (19)	50 (13)	406
4903	DEER CREEK RESERVOIR	42 (11)	19 (5)	42 (11)	35 (9)	0 (0)	58 (14)	196
4904	ECHO RESERVOIR	31 (8)	27 (7)	19 (5)	50 (13)	12 (3)	13 (3)	152
4905	LYNN RESERVOIR	8 (2)	23 (6)	58 (15)	8 (2)	62 (15)	4 (1)	163
4906	FISH LAKE	62 (16)	65 (16)	100 (26)	23 (6)	62 (15)	79 (20)	391
4907	HUNTINGTON NORTH RESERVO	77 (20)	65 (16)	69 (18)	92 (24)	96 (25)	69 (18)	468
4908	JOE'S VALLEY RESERVOIR	81 (21)	58 (15)	62 (16)	85 (22)	46 (12)	96 (25)	428
4909	MINERSVILLE RESERVOIR	0 (0)	44 (11)	27 (7)	12 (3)	85 (22)	0 (0)	168
4910	MOON LAKE	100 (26)	87 (19)	73 (19)	77 (20)	69 (18)	100 (26)	506
4911	NAVAJO LAKE	69 (18)	87 (19)	77 (20)	88 (23)	100 (26)	85 (22)	506
4912	NEWCASTLE RESERVOIR	23 (6)	87 (19)	46 (12)	27 (7)	19 (5)	27 (7)	229
4913	OTTER CREEK RESERVOIR	15 (4)	87 (19)	15 (4)	31 (8)	54 (14)	8 (2)	210
4914	PANGUITCH LAKE	12 (3)	65 (16)	50 (13)	4 (1)	8 (2)	23 (6)	162
4915	PELICAN LAKE	37 (9)	54 (14)	35 (9)	54 (14)	98 (83)	73 (19)	343
4916	PINEVIEW RESERVOIR	50 (13)	15 (4)	38 (10)	58 (15)	4 (1)	58 (14)	223
4917	PIUTE RESERVOIR	27 (7)	31 (8)	8 (2)	15 (4)	38 (10)	46 (12)	165
4918	PORCUPINE RESERVOIR	58 (15)	38 (10)	31 (8)	38 (10)	33 (8)	19 (5)	217
4919	PRUESS RESERVOIR (GARRIS	19 (5)	35 (9)	0 (0)	69 (18)	81 (21)	37 (9)	241
4920	SEVIER BRIDGE RESERVOIR	54 (14)	8 (2)	23 (6)	19 (5)	33 (8)	37 (9)	174
4921	STARVATION RESERVOIR	73 (19)	87 (19)	65 (17)	62 (16)	23 (6)	79 (20)	389
4922	STEINAKER RESERVOIR	85 (22)	87 (19)	88 (23)	96 (25)	27 (7)	65 (17)	448
4923	TROPIC RESERVOIR	65 (17)	50 (13)	54 (14)	46 (12)	90 (23)	58 (14)	363
4924	UTAH LAKE	4 (1)	12 (3)	4 (1)	0 (0)	42 (11)	13 (3)	75
4925	WILLARD BAY RESERVOIR	37 (9)	44 (11)	12 (3)	42 (11)	50 (13)	31 (8)	216
5605	FLAMING GORGE RESERVOIR	90 (23)	0 (0)	92 (24)	81 (21)	62 (15)	90 (23)	415

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4901	BEAR LAKE	540
2	4911	NAVAJO LAKE	506
3	4910	MOON LAKE	506
4	4907	HUNTINGTON NORTH RESERVO	468
5	4922	STEINAKER RESERVOIR	448
6	4908	JOE'S VALLEY RESERVOIR	428
7	5605	FLAMING GORGE RESERVOIR	415
8	4902	LOWER BOWN'S RESERVOIR	406
9	4906	FISH LAKE	391
10	4921	STARVATION RESERVOIR	389
11	4923	TROPIC RESERVOIR	363
12	4915	PELICAN LAKE	343
13	8488	LAKE POWELL	311
14	4919	PRUESS RESERVOIR (GARRIS	241
15	4912	NEWCASTLE RESERVOIR	229
16	4916	PINEVIEW RESERVOIR	223
17	4918	PORCUPINE RESERVOIR	217
18	4925	WILLARD BAY RESERVOIR	216
19	4913	OTTER CREEK RESERVOIR	210
20	4903	DEER CREEK RESERVOIR	196
21	4920	SEVIER BRIDGE RESERVOIR	174
22	4909	MINERSVILLE RESERVOIR	168
23	4917	PIUTE RESERVOIR	165
24	4905	LYNN RESERVOIR	163
25	4914	PANGUITCH LAKE	162
26	4904	ECHO RESERVOIR	152
27	4924	UTAH LAKE	75

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4920 SEVIER BRIDGE RES

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 13260.8

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4920A1	13260.8	0.20	0.25	1.39	5.38	19.54	13.31	13.88	8.21	3.54	0.42	0.57	0.17	5.61
4920A2	12742.8	6.51	8.21	8.50	6.51	7.65	7.36	2.15	2.41	3.11	4.53	5.66	6.23	5.72
4920ZZ	518.0	0.170	0.170	0.142	0.311	0.481	0.340	0.170	0.142	0.113	0.085	0.142	0.170	0.203

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 13260.8
SUM OF SUB-DRAINAGE AREAS = 13260.8

TOTAL FLOW IN = 71.27
TOTAL FLOW OUT = 66.86

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4920A1	11	74	0.082	9	0.059				
	12	74	0.153	14	0.153				
	1	75	0.224	11	0.229				
	2	75	0.246	8	0.272				
	3	75	0.232	8	0.269				
	4	75	0.997	5	0.210				
	5	75	12.403	3	21.889	18	20.331		
	6	75	16.141	7	24.437	22	9.260		
	7	75	20.813	12	24.437				
	8	75	14.272	10	19.312				
	9	75	7.079	16	5.522				
	10	75	0.102	11	0.122				
4920A2	11	74	5.578	9	5.409				
	12	74	6.116	14	6.116				
	1	75	5.947	11	5.663				
	2	75	6.796	8	6.654				
	3	75	6.994	8	6.853				
	4	75	4.219	5	7.023				
	5	75	7.674	3	4.729	18	7.674		
	6	75	15.461	7	15.829	22	17.302		
	7	75	3.879	12	5.012				
	8	75	2.464	10	2.775				
	9	75	3.993	16	3.002				
	10	75	4.842	5	4.417				
4920ZZ	11	74	0.170						
	12	74	0.198						
	1	75	0.198						
	2	75	0.198						
	3	75	0.198						
	4	75	0.340						
	5	75	0.566						
	6	75	0.425						
	7	75	0.198						
	8	75	0.170						
	9	75	0.142						
	10	75	0.113						

APPENDIX C
AND MOUNTAIN DATA

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/12

492001
39 22 20.0 112 01 45.0 3
SEVIER BRIDGE RESERVOIR
49039 UTAH

150891

11EPALES 2111202
0065 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/12	10 50	0000	9.6	9.6	114	1540	8.60	405	0.040	0.800	0.600	0.010
	10 50	0005	9.3	9.6		1530	8.60	382	0.040	0.700	0.600	0.008
	10 50	0015	9.2	9.6		1530	8.60	362	0.030	0.700	0.600	0.006
	10 50	0025	9.2	9.6		1523	8.60	316	0.040	0.700	0.610	0.005
	10 50	0040	9.1	9.8		1521	8.60	324	0.030	0.400	0.600	0.018
	10 50	0061	7.3	9.4		1460	8.55	352	0.030	0.500	0.590	0.013
75/08/12	08 00	0000	18.5	7.0	60	2197	8.40	334	0.040	0.800	0.290	0.005
	08 00	0005	18.8	7.0		2200	8.45	342	0.040	0.800	0.290	0.006
	08 00	0025	18.6	6.2		2197	8.40	368	0.020K	0.500	0.290	0.004
	08 00	0051	15.9	2.6		2097	8.15	376	0.020	0.500	0.430	0.010
75/09/24	13 55	0000	19.6	7.2	60	1895	8.55	425	0.100	0.800	0.190	0.004
	13 55	0005	19.5	7.2		1885	8.60	395	0.080	0.700	0.190	0.003
	13 55	0015	18.9	6.2		1859	8.50	450	0.120	0.700	0.190	0.004
	13 55	0030	18.7	6.6		1846	8.60	440	0.090	0.800	0.180	0.005
	13 55	0049	18.6	6.4		1842	8.50	425	0.110	0.600	0.190	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

492001
39 22 20.0 112 01 45.0 3
SEVIER BRIDGE RESERVOIR
49039 UTAH

150891

11EPALES 2111202
0065 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCOT LT REMNING PERCENT
75/05/12	10	50 0000	0.022	3.1	
	10	50 0005	0.021		
	10	50 0015	0.020		
	10	50 0025	0.024		
	10	50 0040	0.019		
	10	50 0061	0.023		
75/08/12	08	00 0000	0.023	2.0	
	08	00 0005	0.022		
	08	00 0025	0.024		
	08	00 0051	0.032		
75/09/24	13	55 0000	0.031	3.8	
	13	55 0005	0.022		
	13	55 0015	0.023		
	13	55 0030	0.022		
	13	55 0049	0.022		

STORET RETRIEVAL DATE 76/08/12

492002
39 22 31.0 111 59 09.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH

150891

11EPALES 2111202
0039 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/12	10 45	0000	10.2	8.6	74	2181	8.40	350	0.040	0.700	0.600	0.017
	10 45	0005	9.8	9.4		2143	8.40	356	0.030	0.400	0.610	0.020
	10 45	0015	9.7	9.0		2154	8.45	366	0.030	0.400	0.610	0.020
	10 45	0035	9.4	9.2		2147	8.50	332	0.030	0.500	0.610	0.016
75/08/12	08 20	0000	18.6	7.0	48	2200	8.40	354	0.080	0.600	0.270	0.006
	08 20	0005	19.1	6.4		2203	8.50	346	0.080	0.600	0.270	0.005
	08 20	0015	19.0	5.8		2200	8.40	370	0.080	0.600	0.280	0.007
	08 20	0039	18.1	4.6		2167	8.35	352	0.060	0.600	0.330	0.015
75/09/24	13 35	0000	19.0	7.0	60	1857	8.50	435	0.080	0.800	0.200	0.005
	13 35	0005	18.8	6.8		1868	8.50	465	0.090	0.800	0.200	0.004
	13 35	0015	18.4	7.0		1886	8.50	405	0.130	0.800	0.220	0.004
	13 35	0035	18.1	7.2		1874	8.55	430	0.110	0.800	0.220	0.005

STORET RETRIEVAL DATE 76/08/12

492002
39 22 31.0 111 59 09.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH
150891

11EPALES 2111202
0039 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/12	10 45	0000	0.026	17.2	
	10 45	0005	0.023		
	10 45	0015	0.024		
	10 45	0035	0.026		
75/08/12	08 20	0000	0.031	5.4	
	08 20	0005	0.030		
	08 20	0015	0.032		
	08 20	0039	0.036		
75/09/24	13 35	0000	0.026	4.9	
	13 35	0005	0.027		
	13 35	0015	0.029		
	13 35	0035	0.032		

STORET RETRIEVAL DATE 76/08/12

492003
39 18 08.0 111 54 59.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH

150892

11EPALES 2111202
0015 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/12	11 15	0000	12.2	9.4	21	2147	8.65	360	0.030	0.800	0.310	0.015
	11 15	0005	11.7	9.5		2165	8.65	316	0.050	0.800	0.310	0.015
	11 15	0011	11.4	9.2		2134	8.70	308	0.050	0.700	0.310	0.012
75/08/12	08 40	0000	19.0	7.0	6	2730	8.50	370	0.060	0.700	0.270	0.010
	08 40	0003	19.1	6.2		2729	8.50	406	0.080	1.100	0.270	0.013

STORET RETRIEVAL DATE 76/08/12

492003
39 18 08.0 111 54 59.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH

150892

11EPALES 2111202
0015 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/12	11 15	0000	0.057	2.1	
	11 15	0005	0.062		
	11 15	0011	0.065		
75/08/12	08 40	0000	0.033	54.1	
	08 40	0003	0.129		

STORET RETRIEVAL DATE 76/08/12

492004
39 20 01.0 112 56 36.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH

11EPALES 760114 2111202
0009 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/09/24	13 00	0000	16.4	9.6	9	1809	8.30	435	0.030	1.400	0.980	0.008
	13 00	0007	16.3	9.6		1852	8.30	430	0.040	1.600	1.210	0.010

STORET RETRIEVAL DATE 76/08/12

492004
39 20 01.0 112 56 36.0 3
SEVIER BRIDGE RESERVOIR
49023 UTAH

11EPALES 760114 2111202
0009 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/09/24	13 00	0000	0.090	71.4	
	13 00	0007	0.088		

APPENDIX E

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/08/12

4920A1
39 22 27.0 112 02 20.0 4
SEVIER RIVER
49 15 SCIPIO
0/SEVIER BRIDGE RES 150891
GAGE STATN .5 MI DWNSTRM FRM YUBA DAM
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/09	12 00		0.096	0.600	0.017	0.035	0.040
74/12/14	10 30		0.080	1.300	0.040	0.005	0.020
75/01/11	10 00		0.128	1.300	0.030	0.005K	0.020
75/02/08	09 00		0.376	1.500	0.048	0.016	0.020
75/03/08	10 10		0.376	0.700	0.028	0.008K	0.010
75/04/05	10 00		0.430	1.150	0.060	0.010	0.020
75/05/03	10 00		0.520	0.600	0.020	0.005	0.020
75/05/18	11 52		0.540	1.650	0.040	0.010	0.010
75/06/07	11 55		0.480	1.500	0.100	0.010	0.040
75/06/22	11 30		0.370	0.650	0.055	0.005	0.020
75/07/12	12 10		0.250	0.250	0.070	0.005K	0.040
75/08/10	10 10		0.290	1.250	0.045	0.015	0.020
75/09/16	09 35		0.170	1.300	0.145	0.015	0.030
75/10/11	15 20		0.085	0.600	0.020	0.010	0.040

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E
RETAINED WASTEWATER
TREATMENT AND

STORET RETRIEVAL DATE 76/08/12

4920A2
39 12 32.0 111 51 32.0 4
SEVIER RIVER
49 7.5 GUNNISON
T/SEVIER BRIDGE RES 150891
BNK 40 FT FRM DRT RD 1.5 M SSW FAYETTE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/09	13 30		2.600	0.500	0.025	0.045	0.045
74/12/14	11 40		2.640	1.500	0.070	0.035	0.190
75/01/11	11 45		3.120	1.200	0.040	0.030	0.150
75/02/08	10 00		2.500	2.600	0.056	0.032	0.170
75/03/08	11 00		2.130	1.550	0.040	0.032	0.180
75/04/05	11 00		1.500	1.400	0.065	0.015	0.110
75/05/03	10 45		2.500	1.000	0.030	0.025	0.140
75/05/18	10 45		1.570	1.450	0.025	0.035	0.310
75/06/07	10 15		0.980	2.400	0.340	0.030	
75/06/22	10 20		0.920	1.400	0.035	0.025	0.200
75/07/12	11 30		2.500	0.900	0.108	0.030	
75/08/10	09 00		2.900	1.100	0.020	0.015	0.160
75/09/16	08 40		3.100	1.900	0.050	0.025	0.250
75/10/05	21 00		3.000	0.800	0.085	0.035	0.100

STORET RETRIEVAL DATE 76/08/12

4920AA NO4920AA P001500
39 09 00.0 111 50 00.0 4
GUNNISON
49 7.5 GUNNISON
T/SEVIER BRIDGE RES. 150891
SEVIER RIVER
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
75/01/22	15	15	2.320	1.000K	0.050K	0.050K	0.100K		0.120
75/02/19	11	45	0.062	29.000	8.700	2.450	4.400		0.120
75/03/18	12	00	0.080	12.000	4.800	2.800	3.300		0.120

K VALUE KNOWN TO BE
LESS THAN INDICATED

34